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24SEP03 E839610-1 D02776
P01/7700 0.00-0322351.8

Request for grant of a patent

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The Patent Office

Cardiff Road
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1. Your reference — IP/P7236

2. Patent application number *(The Patent Office will fill in this part)* — 0322351.8 — 24 SEP 2003

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

QINETIQ LIMITED
Registered Office 85 Buckingham Gate
London SW1E 6PD
United Kingdom

Patents ADP number *(if you know it)* 8183857001

If the applicant is a corporate body, give the country/state of its incorporation — GB

4. Title of the invention — Fibre-Optic Surveillance System

5. Name of your agent *(if you have one)* — Bowdery Anthony Oliver

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*

QINETIQ LIMITED
IP Formalities
A4 Bldg
Cody Technology Park
Ively Road
Farnborough
Hants GU14 0LX United Kingdom

Patents ADP number *(if you know it)* 8183873001

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and *(if you know it)* the or each application number

Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number or earlier application	Date of filing *(day / month / year)*

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? *(Answer 'Yes' if:*

a) any applicant named in part 3 is not an inventor, or
b) there is an inventor who is not named as an applicant, or
c) any named applicant is a corporate body. See note (d))

Yes (b)

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9. Enter the number of sheets for any of the following items you are filing with this form. Do not count copies of the same document

Continuation sheets of this form	0
Description	5
Claim(s)	1
Abstract	1
Drawing(s)	1 + 1 SV

10. If you are also filing any of the following, state how many against each item.

Priority documents	0
Translations of priority documents	0
Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	1 + 2 copies
Request for preliminary examination and search *(Patents Form 9/77)*	1
Request for substantive examination *(Patents Form 10/77)*	0
Any other documents *(please specify)*	0

11. I / We request the grant of a patent on the basis of this application.

Signature S J Knight Date 22.9.2003

12. Name and daytime telephone number of person to contact in the United Kingdom

Mrs Linda Bruckshaw
01252 392722

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Notes

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FIBRE-OPTIC SURVEILLANCE SYSTEM

The present invention relates to fibre-optic surveillance systems.

It is known to use optical fibres as sensing elements to detect pressure, strain etc, with conditions external to an optical fibre being inferred from changes in characteristics, such as amplitude, frequency or polarisation, in light output from the fibre. An example is the pressure sensor described in European Patent number 0 365 062.

One approach to perimeter surveillance is to arrange a single length of optical fibre below ground level around a perimeter to be monitored, and to couple radiation from an LED or laser-diode into the fibre. Pressure on the fibre due to the weight of a person, vehicle or other object crossing a perimeter defined by the fibre causes a change in the amount of radiation back-scattered within the fibre (due to bending of the fibre), and hence the presence of an intruder can be detected. However, such a system has three significant disadvantages, namely (i) the position at which an intruder crosses the perimeter cannot be determined accurately, (ii) a significant false-alarm rate and (iii) no information is given about the nature if the intruding person or object.

According to a first aspect of the invention, these problems are ameliorated by a fibre-optic sensor for a surveillance system, in which the sensor comprises a serial array of fibre-optic point sensors, wherein successive point sensors are linked by a distributed fibre-optic sensor.

To provide positional information on intruders events, the sensor is preferably comprised in a fibre-optic surveillance system which further comprises an interrogation system (12) for analysing optical signals received from the sensor to establish the position of an intruder event.

Corresponding to the first aspect of the invention, a second aspect thereof provides a method of establishing the position at which an object moving on a surface crosses a closed path, or an open path of fixed length, thereon, characterised in that the method comprises the steps of

(i) positioning a sensor according to claim 1 on or below said path; and

(ii) analysing optical signals received from the sensor to establish the position of the object along the path, or the position at which the object has crossed said path.

An embodiment of the invention are described below by way of example only and with reference to the accompanying drawing in which schematically illustrates a fibre-optic perimeter surveillance system according to the invention.

In Figure 1, a fibre-optic perimeter surveillance system according to the invention is indicated generally by 10. The system 10 comprises a series of fibre-optic point sensors 16A, 16B, 16C, 16D, ..., 16N (in this example, geophones) optically linked by a series of distributed fibre-optic sensors 18B, 18C, 18D, ..., 18N to form a fibre-optic sensor array 15. A data link 14 couples the geophone 16A to an interrogation unit 12. The data link 14 may be a length of optical fibre, so that optical signals are passed to the interrogation unit 12, or alternatively it may comprise a detector which converts optical signals into electrical signals and either a fixed electrical, or wireless, link to the interrogation unit 12.

The distributed fibre-optic sensors 18B, 18C, 18D, ..., 18N each have a physical length of 100m. There are 250 geophones in the array 15, so that the separation of geophones 16A, 16N may be up to approximately 24.9km.

Each of the geophones 16A, 16B, 16C, 16D, ..., 16N comprises approximately 100m of optical fibre wound onto a flexural disc, and is able to measure acceleration and displacement via strain induced in the fibre. Each of the distributed sensors 18B, 18C, 18D, ..., 18N comprises 100m of optical fibre packaged within a cable and can measure pressure on, or bend of, the cable, also via strain induced on the fibre.

The array 15 may be arranged in any desired configuration, for example it may be arranged around a closed path to provide perimeter surveillance for e.g. a building; alternatively it may be arranged in a linear manner to provide information on the location of a person/object crossing a straight line defined by the array 15.

The system 10 operates as follows. When a person or object crosses a line or perimeter on or underneath which the array 15 is positioned, radiation within a distributed fibre-optic sensor corresponding to the location where the person/object crosses is reflected back to geophone 16A and a corresponding signal giving approximate location is passed to the interrogation unit 12. More particularly the interrogation unit 12 is able to identify that a crossing has occurred somewhere along the length of the array 15. Radiation is also reflected back from the geophones at either end of that distributed sensor, and corresponding signals are also passed to the interrogation unit 12. The interrogation unit 12 carries out triangulation of the signals received from the distributed sensor and the geophones at either end of it to accurately determine the location along the array 15 at which the person/object has crossed on the basis of the time at which signals are received. By using data from both types of sensor, it is possible to provide much more accurate classification of the person/object than is achievable through use of one sensor type alone. Improved classification results in a lower false-alarm rate.

In the example system 10, the point fibre-optic sensors are geophones, however other types of fibre-optic point sensor may be used.

The number of point and distributed sensors may vary according to both the length of a perimeter or path which is desired to be monitored, and the accuracy with which it is desired to locate intruder events. The simplest fibre-optic sensor of the invention would comprise a single distributed sensor having a point sensor at each end.

CLAIMS

1. A fibre-optic sensor (15) for a surveillance system (10) characterised in that the sensor comprises a serial array (15) of fibre-optic point sensors (16), in which successive point sensors are linked by a distributed fibre-optic sensor (18).

2. A fibre-optic surveillance system (10) characterised in that the system comprises a fibre optic sensor (15) according to claim 1 and an interrogation system (12) for analysing optical signals received from the sensor to establish the position of an intruder event.

3. A method of establishing the position at which an object moving on the earth's surface crosses a closed path, or an open path of fixed length, thereon, characterised in that the method comprises the steps of

(i) positioning a sensor according to claim 1 on or below said path; and

(ii) analysing optical signals received from the sensor to establish the position of the object along the path, or the position at which the object has crossed said path.

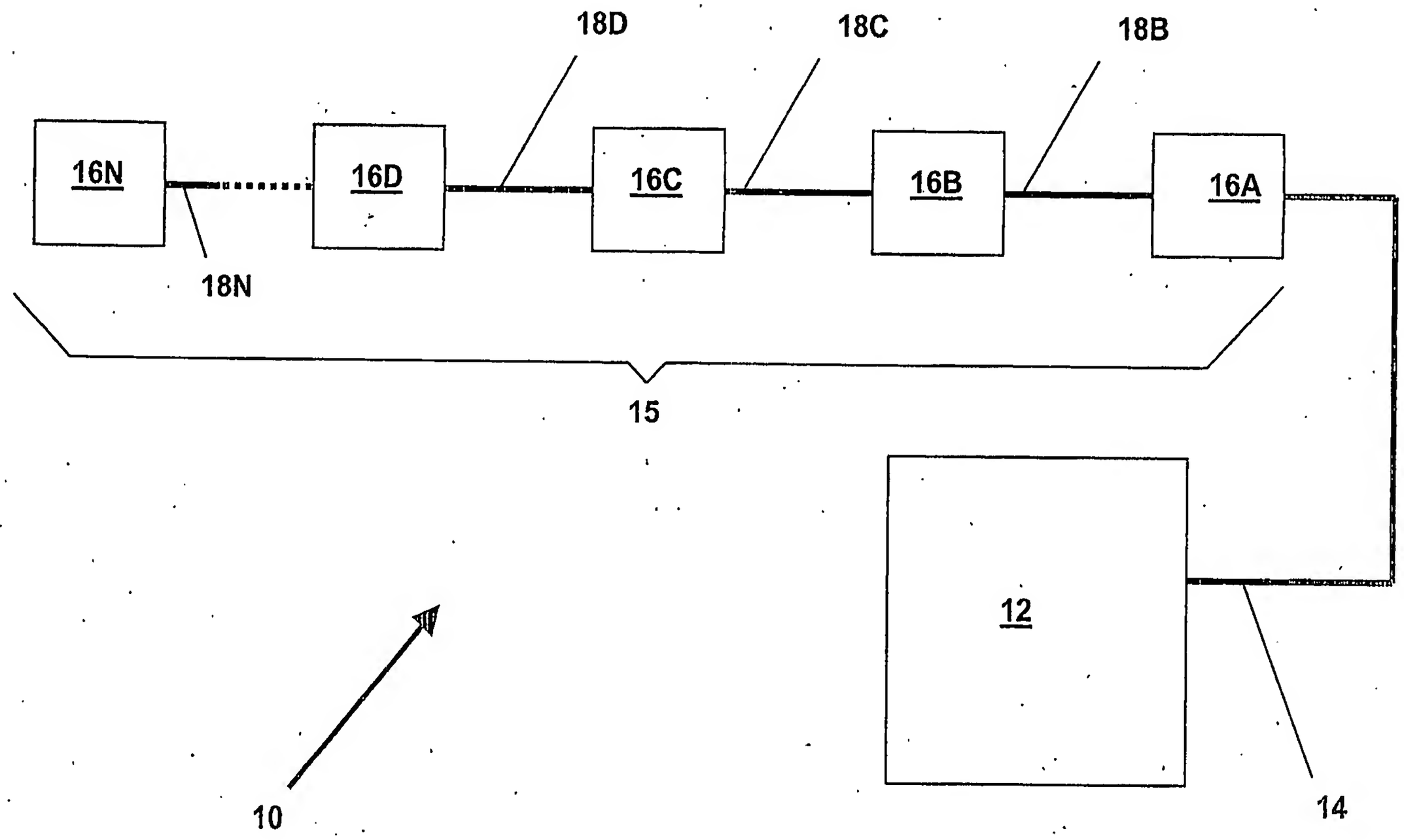
ABSTRACT

FIBRE-OPTIC SURVEILLANCE SYSTEM

A fibre-optic surveillance system (10) includes a fibre-optic sensor (15) comprising a serial array (15) of fibre-optic point-sensors (16), successive point-sensors being linked by a distributed fibre-optic sensor (18). The system allows the location of intruder events along the sensor to be determined, and provides a reduction in the incidence of false-alarms compared to prior art systems.

Figure 1 should accompany the abstract.

Fig 1



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